PROGRESS REPORTS

FROM

EXPERIMENT STATIONS

SEASON 1951-52

NORTHERN NIGERIA

PUBLISHED BY

THE EMPIRE COTTON GROWING CORPORATION,
12 CHANTREY HOUSE, ECCLESTON STREET,
LONDON, S.W.1.

1953

The price of this Progress Report and of the other Progress Reports issued and to be issued for the 1951-52 season is 9d each, post free. The price of the full set of Reports for the 1951-52 season (approximately 12 Reports, despatched as published) is 7s. 6d., post free.

Past Progress Reports are available (in seasonal volumes only) at the prices shown below. Volumes not listed are out of print.

1923-25 (one volume)	2s.
1926-27, 1931-32, 1934-35, 1935-36 ...	2s. 6d. each
1942-43, 1945-46, 1946-47, 1947-48, 1948-49, 1949-50, 1950-51	3s. 0d. each

NORTHERN NIGERIA

PROGRESS REPORT FOR THE SEASON 1951-52

Planting Period: June to August.
Picking Period: November to February.
Close Season: April to Early June (not yet universally enforced).
Rainfall; Samaru, March-November 1951: 45·67 inches.
Rainfall Average for 28 seasons: 43·67 inches.

GENERAL INTRODUCTION

BY

H. E. KING.

Season.

The 1951-52 crop showed a spectacular increase over the previous season, which was itself a record one, the output of 400 lb. bales for export being almost 50% higher. Figures for the last four seasons are as follows:—

1948-49 — 50,944 bales (47,903).
1949-50 — 61,218 bales (57,507).
1950-51 — 76,390 bales (75,054).
1951-52 — 113,510 bales (110,570).

(The figures in brackets are for the Allen crop i.e. excluding Benue ungraded ginned at Lokoja.)

The increased production followed an increase in seed issue of 17% and was accompanied by a higher return per ton of seed issued than has been recorded since 1940-41.

Favourable weather, in particular quite exceptional late rains continuing into November, was presumably mainly responsible for this higher return. It is likely to have proved very beneficial to the later planted cotton which always makes up a substantial proportion of the total acreage.

At Samaru, however, with early July sowing, the yields were not favourably affected by this late rain. Flowering continued longer and the arrival of the crop was protracted, but much of the earlier fruit was lost by shedding. Final yields were in general a little below those of last season.

It seems probable that this result is bound up with the influence of rainfall on insect pests. The shedding was associated with extremely severe and widespread damage of the type caused by *Lygus* and found here in conjunction with large populations of *Campylomma*—a related genus of Miridae. This damage has been noted now for three seasons but was far worse and more widespread this season than heretofore. It is much more apparent on early-planted well-grown cotton and may, therefore, have a much less serious effect on the yield of the commercial crop than on experimental plots at Samaru.

Red bollworm incidence was high but damage on most of the plots at Samaru was not excessive. Insect pest incidence is dealt with fully in the Entomology section. The grade of the commercial crop, which (apart from contamination with leaf, etc.) depends largely on the degree of bollworm and stainer damage, was lower than last season.

As recorded last year, characteristic damage by *Xanthomonas malvacearum* was late in appearing though infection eventually became fairly widespread. The part that this disease plays in damage to bolls in the absence of heavy angular leaf spot attack or stem lesions is not clear; it may be considerable.

Staff, Organization, Buildings and Land.

Mr. King returned from leave in mid-June 1951.

The increasing size of the crop, and the accumulating evidence that expansion is likely to continue, led to the posting of a second plant breeder to Samaru and, by arrangement with the Director of Agriculture and the Cotton Marketing Board, a seed multiplication officer to work at Gombe in Bauchi Province.

Mr. J. H. Saunders arrived at Samaru in early September to assist with the cotton breeding work and Mr. A. M. Krzywon was posted to Gombe in December 1951.

With a second officer at Samaru Mr. King was able to make a tour of Gombe district and, later, to visit Maiduguri and Lake Chad. The organization and regular inspection of a widespread series of district variety tests now becomes an immediate possibility.

The development of a seed multiplication scheme at Gombe should enable this area and the surrounding regions to be supplied with improved seed more cheaply and speedily.

Mr. A. F. H. Baillie left Samaru in April 1952, after completing the entomological work of the 1951-52 season, and has since left the Corporation's service. Mr. M. A. Choyce has been appointed in his place.

There were a few changes amongst the Nigerian assistants, but no addition to their number during the season. Recruits of the necessary standard are difficult to find.

The new laboratory and insectary for entomological work was completed and put into use.

A building to house a power-driven saw gin and a delinter gin was started at Samaru with funds provided by the Cotton Marketing Board.

With the help of the Engineering Branch of the Department of Agriculture a further area of thick bush land was cleared and levelled for planting.

PLANT BREEDING

BY

H. E. KING.

Breeding and Selection Work.

Owing to the break caused by leave, much of the material from the 1950-51 breeding work could not be dealt with in time for inclusion in the 1951-52 plantings. The routine laboratory determinations of ginning percentages and lint lengths were successfully completed by the Nigerian assistants, but the sifting of all the accumulated data proved impossible and it was thought best to cut down considerably for one season, carrying on only the more immediately promising lines of work with the emphasis on replicated tests of small bulks.

All the material left over in this way was worked through during the course of the season and much of it has since been planted.

Amongst the material not held up were twenty progenies from the blackarm resistant selection BAR D28. These were included in a progeny row test with five replications and gave striking differences in earliness, yield, jassid resistance, lint length and ginning percentage. The best five have been carried forward to a replicated test against 26C and other types.

A plot of bulk BAR 17/1 (Allen derivative), sown as a source of single plant selections for better yield and lint length, was studied in detail by Mr. Saunders and numerous selections with contrasting characters were made for further study.

Further selections were made in a plot of reselected MU8A. Repeated re-selection appears to have given a small improvement in lint length. A bulk has been made up for trial against unselected stock.

Very large numbers of new single plant selections were made in multiplication plots of 26C sub-strains. These were later drastically reduced in number by rejecting all which showed the heavy leaf fretting and tattering ascribed to *Campylomma*. A small bulk was however made up from heavily tattered plants for trial against a similar bulk from resistant plants to test the practicability of obtaining a degree of resistance by this method.

Replicated Trial of Progeny Bulks.

A strains test containing new bulks from progeny rows of the previous season, together with a few mixtures and some control types, was arranged as a simple lattice with 36 strains in eightfold replication. Sown on 6th July, each plot was of 2 rows at 3-foot spacing, 21 stands per row 18″ apart and two plants per stand, the plot area being approximately 1/230 acre.

Growth was good but rather irregular. Yields were disappointing in view of the strong vegetative growth and good conditions and, over the bulk of the material, strain differences in growth and cropping were not well

marked. This may have been a consequence of the widespread bud and boll shedding to which all strains seemed almost equally susceptible. It was not possible to relate this beyond doubt to any insect or disease damage but the foliage of a large proportion of the plants showed severe fretting and tattering ascribed to *Campylomma sp.* Estimates of the severity of this, analysed statistically, showed significant differences between strains but none was satisfactorily resistant.

In spite of the possible levelling down of potential yields there remained a marked (and statistically significant) difference between the best and the worst, the full range being from 806 to 592 lb. of seed cotton per acre with a standard error of 30 lb. (4·3% of the mean).

Twenty-nine of the new bulks were from progenies tested last season in connection with the production of the new nucleus stock of Samaru 26C. Data on the behaviour of these in the 1950-51 test of 144 progenies in four-fold replication (see page 108 of 1950-51 report) were available for comparison with the 1951-52 results.

As might well be expected, in view of the marked difference in weather and on acount of the high error of the progeny tests, there were a number of apparent contradictions in the seed cotton yields though the overall general agreement was sufficient to give a significant positive correlation between the two seasons. In ginning percentages and lint lengths agreement was in general quite close with no really bad discrepancy.

To what extent the inconsistent yield differences reflect real strain by season interaction is a matter of conjecture but it seems probable that, at least in some cases, there has been a true differential response. The two highest yielding strains of all in 1950-51, for instance, were both below average in 1951-52. Against this the three highest yielders of 1951-52 were amongst the nine highest (out of 144) in 1950-51. It is clear that these three are capable of good yields in two contrasting seasons. Two of them seem at least equal to 26C itself in quality and all three are being included in widespread larger-scale trials in the coming season.

A further eleven strains have been selected for continued trial at Samaru. These include one whose spinning test result (on 1950-51 sample) was outstanding, the yarn strength being 15% above that of 26C control.

The differences in yield between the various bulks, each representing a single progeny, and the mixtures made up from a number of these progenies were small and not consistent but there was some indication that a mixture of a large number gave a higher yield than the average of the components. Thus the new nucleus stock made up by mixing seed from 66 progenies gave a yield above the mean of all those of its components included in this experiment. These totalled 17 only but were in general the higher yielding (in 1950-51) of the 66. It also outyielded a mixture of five progenies chosen from the 66 as especially promising. In neither case, however, was the difference statistically significant. The yield of the mixture of five was

almost exactly the same as the mean yield of the five components tested separately.

Further studies on these lines are being planned, but in the meantime the policy of mixing closely related progenies whose lint characters have been found not to differ noticeably is being continued. Mixing the seed produced by a number of lines provides the quantity necessary for variety tests at a series of stations while the components of the mixture can be re-tested against each other (and against the mixture) in a smaller scale test at Samaru. In the first stage of multiplication also, the components can be kept separate.

Seed Multiplication.

Small multiplication plots were grown of each of the 29 new bulks referred to in the last section. The area per plot varied from $\frac{1}{8}$th to 1/20th of an acre according to seed available and the relative promise of the progeny in 1950-51. Unfortunately, as pointed out in the last section, the 1951-52 strains test results sometimes conflicted with the previous findings and strains from which the maximum seed was later needed had been allocated to the smaller plots. In consequence, in spite of good yields (700-800 lb. of seed cotton per acre) the seed obtained was inadequate. The position was made much worse by a burglary of the building in which the produce was stored, with the loss of half the produce of several plots. These included, by particular ill-luck, that of the highest yielding of all the strains under trial.

It was possible, however, at the end of the season, to combine contributions from ten plots and make up a quantiy of 160 lb. as a new bulking of 26C derivation to go forward to the 20 acre stage of seed multiplication at Daudawa under the description of " Select Progeny Bulk." The lines chosen for this were those whose overall records in 1950-51 and 1951-52 for yield, ginning percentage and lint length were most satisfactory and whose spinning test results on 1950-51 samples indicated they were not below the standard of 26C.

Concurrently with the growth of this new bulk in the 20 acre stage at Daudawa, it is being tested at eight points throughout the cotton growing areas in replicated experiments.

The multiplication, by the Department of Agriculture, of bulk seed of Samaru 26C was aided by the favourable season. Yields at Daudawa and in Southern Katsina generally were high* and the various stages of the multiplication scheme together produced over 8,500 tons of 26C seed. This has been distributed for sowing the 1952-53 crop throughout Katsina and Sokoto. These are the two most important cotton growing provinces, which between them take 63% of the annual seed issue and produce 70% of the crop.

*The yield of the 20-acre stage, sown with new nucleus stock, was 646 lb. seed cotton per acre, a record for the multiplication scheme.

At the end of 1952-53 season there will be more than sufficient 26C seed to replace older stocks in all other areas. Part of this will come from a chosen area in Gombe District sown with 180 tons of seed transported from Funtua and distributed under the supervision of the Seed Multiplication Officer.

Gombe District appears a most promising area for this purpose. The standard of native cultivation is high and the climate and soils suitable. In the 1951-52 season at least, insect pest infestation was not unduly heavy. Interest in cotton as a cash crop is developing rapidly and a ginnery with a capacity of 10,000 bales has recently been erected there. Seed produced at Gombe could be distributed in parts of Bornu and Adamawa as well as the cotton growing areas of Bauchi Province.

Replicated Trials of Seed Stocks.

Tests were laid down as usual at Samaru and Daudawa to compare amongst themselves the various stocks of 26C seed representing successive issues from Samaru for the Daudawa Multiplication Scheme. At each site the design was balanced incomplete blocks, nine treatments, eight replications, sown early July. The Samaru plots were 1/84th acre with spacing 18″ on 3-foot ridges, 2 plants per hole. The Daudawa plots were 1/60th acre with spacing 15″ on 3-foot ridges thinned to 3 plants per hole.

The Samaru experiment gave unusually strong vegetative growth and high yield (830 lb. seed cotton per acre) but the yield was greatly below what might have been expected from such growth. There was very heavy loss of fruiting buds and suppression of sympodial growth typical of that associated with *Lygus* in Uganda (but here ascribed provisionally to *Campylomma*).

There were no significant differences between the seed stocks in yield and very little difference in other characters. The Stage 3 stock, originating from seed issued from Samaru in 1947 and multiplied for four seasons, showed however a slightly lower ginning percentage and greater range in lint length than the subsequent issues, and was recognisable in the field by reason of having a proportion of jassid-susceptible plants. Apart from greater uniformity, the new nucleus stock, the most recent issue, showed no observable difference from the issues of 1948, 1949 and 1950.

The growth of the Daudawa experiment was much inferior to that at Samaru and the mean yield less than half (407 lb. seed cotton per acre). Poorer soil and waterlogging, together with weed competition (due to difficulty of weeding while the soil is waterlogged), seem to be the reasons for the consistently lower yields on Daudawa experimental farm.

Here, also, there were no significant differences between seed stocks in yield. The ginning percentages and lint length data generally confirmed those of the Samaru experiment but the new nucleus stock showed here a slightly higher ginning percentage than any of the others.

It is clear from the results of tests such as these over the last three seasons that the relatively small differences in yield, which are all that can be expected between such seed stocks, cannot be detected by the methods used. The tests do, however, serve a purpose in showing the absence of large differences which might have followed serious contamination or admixture. The ginning percentage and lint quality comparisons are useful in this connection also.

District Variety Tests.

These tests were discontinued for the season. They have since been resumed on a more widespread scale embracing eight stations.

Observation Plots of Egyptian Type Cotton.

The possibility of producing Egyptian type cotton in Nigeria has been the subject of a number of enquiries from several sources. Some small trials have, therefore, been made with a number of types obtained from the Anglo-Egyptian Sudan. Growth on alluvial flats after the recession of the annual flood (as in the Gash and Baraka Deltas of the Sudan) would appear the most promising form of cultivation but actual irrigation has been proposed both in the vicinity of Lake Chad and in Niger Province.

Trial plots at ten scattered points around Maiduguri and along the shores of Lake Chad, with a range of sowing dates according to the time at which the soil was uncovered by the floods, were planted by the Agricultural Superintendent at Maiduguri using seed of blackarm resistant strains of Sudan Sakel and X1730A type (*G. barbadense*).

Inspected in March 1952, none of these trials was found to be more than partially successful. Only the earliest planted (late September 1951) were reasonably well grown and these did not promise much of a crop. What bolls there were showed *extremely* high infestation with spiny or Egyptian bollworm (*Earias spp.*—probably mostly *E. insulana*).

This pest, together with a heavy infestation of the cotton seed bug (*Oxycarenus spp.*), was also found on *Abutilon sp.*, a common weed, and was abundant on the "native" cotton (typically *G. hirsutum* var. *punctatum*) which is widespread in this region.

On the shores of Lake Chad itself patches of this cotton, often acres in extent in almost pure stand, were seen. It is understood that it is cultivated as a perennial over wide areas on both sides of the lake for local use. To eliminate it would probably be extremely difficult and unless this was done it is impossible to visualize a successful crop of saleable Egyptian type cotton anywhere in the vicinity.

Although very undesirable indeed, the existence of this perennial and pest-infested crop is not so serious an objection to the growth of annual crops of American (*G. hirsutum*) cotton, especially as a good yielding annual type could be expected in time to replace much of the *punctatum* for local

uses. Issues of seed of Allen have been made in various parts of Bornu Province for some years and in the coming season markets to purchase cotton for export are being opened. It would appear preferable to continue this policy, and to aim at an annual crop of *G. hirsutum* planted in June or July on rainfed upland areas, leaving the flooded areas (which cannot be planted much before October at the very earliest) entirely for crops other than cotton.

A crop of Allen cotton on Maiduguri experimental farm yielded 340 lb. of seed cotton per acre in a year of below average rainfall. It is probable that an earlier maturing strain of American cotton would do better. Trials of a range of types giving lint of approximately Allen quality are being planned.

Further trials of Egyptian type cotton on flood land, with pump irrigation if required, have now been planned for Niger Province. Here also there is likely to be heavy pest infestation and a conflict between the rainfed crop, with its close season from March to June, and the October or November planted flood crop which, if successful, will be carrying bolls into June.

BAR 4/16, the blackarm resistant Sudan strain of X1730A has been grown on a small scale for two seasons at Samaru solely as a rainfed crop sown in July. In both seasons the plants grew well and produced a crop. Its yield, relative to Samaru 26C, is now being tested in a replicated experiment and, if promising, a lint sample will be sent for spinning.

Spinning Test Results on 1950-51 Crop.

Samples from the 1950-51 experiments were submitted to the British Cotton Industry Research Association for examination and spinning at the Shirley Institute. Some of the points in the reports are briefly summarized below.

The samples as a whole gave distinctly better yarn strength than those of the 1949-50 and 1948-49 seasons.

The comparison of 26C seed stocks with three different stocks of Allen seed gave results in keeping with previous tests. The appearance of the 26C yarns was on the whole slightly better than that of the Allens indicating that 26C is maintaining its promise as a less neppy strain than Allen.

There was little to choose between the three Allens. Amongst the 26C stocks differences were small but a bulk representing selected progenies gave a better yarn strength than the remainder and was also the best in appearance of all the samples sent.

Differences between the samples from the district variety tests were somewhat inconsistent. Those from Kano showed the lowest maturity ratios, presumably reflecting the less adequate rainfall there. The yarn strengths were in general good from all sites.

Samples from successive pickings of the permanent rotation experiment showed that yarn strength and maturity were well maintained up to the third picking (13th January) but fell for the fourth (taken 31st January).

Amongst a set of 27 progeny row samples, corrected lea count × strength products (at 40's) ranged from 1653 to 2191 with a control bulk 26C giving 1909. Amongst a further set of 37 (all 26C derivatives) the range was from 1704 to 2260 with three control samples averaging just 2000. It is clear that there is a wide field for reselection for spinning quality within 26C.

Other Experiments and Observations.

Permanent Rotation Experiment.

This was continued in co-operation with the Botanist and Entomologist. It is now in its fourth season and the yields and observational data are being accumulated in readiness for an analysis of the seasonal fluctuations attributable to weather. With only two replications in each season it appears that adjustments will be necessary to eliminate differences between the plots used in different seasons.

The yield of the plots under cotton this season was 431 lb. of seed cotton per acre, a 9% reduction from last year. This experiment appeared to suffer heavier insect damage than most of the Samaru cotton. It is also on relatively poor soil and the cotton crop is not manured.

Uniformity Trial.

In view of the difficulty being experienced here in obtaining results of even moderate accuracy from replicated field experiments,* studies are being made of methods of overcoming more effectively the very high soil heterogeneity.

In this connection a visit was paid in 1951 to the Horticultural Research establishment at East Malling where variations in fertility following the grubbing of fruit trees were under study.

The methods in use there of deep ploughing (8″) and heavy manuring have the disadvantage, for cotton variety tests here, of departing very far from the conditions under which these varieties will be grown commercially. Quite deep ploughing by heavy tractor has, moreover, been tried here with no apparent improvement and neither organic manuring, at the low rate practicable here, nor dressings of superphosphate have proved a solution.

This season a field of one acre newly cleared from heavy secondary bush vegetation was tractor-ploughed, manured with FYM at two tons per acre, ridged at 3-foot spacing and planted to a uniform crop of pure 26C stock giving an almost perfect full stand. At harvest the produce of each 15-foot ridge length was weighed separately to give yields from 800 plots of 1/880 acre net area each.

The yields, expressed as seed cotton per acre, varied from 140 to 2275 lb. about a mean for the whole field of 674 lb.

---

*See 1950-51 report, p. 110, and 1949-50 report, p. 92.

Combining the units into sets of ten, to give plots of approx. 1/88 acre, resulted in yields from 293 to 1608 lb. Superimposing on these an eight by eight Latin square layout gave a residual standard error of 24·6% of the mean. (Differences between treatments would have had to exceed 25% to be significant.)

This field is by no means unrepresentative of much of the land which has perforce to be used for experimental work here. It has been sown to cotton again and the persistence of the soil patches will be studied.

Manurial Experiments.

Following up a reference to the effect of sodium on shedding of cotton fruits* a test was arranged with the co-operation of the Senior Chemist at Samaru in which sodium chloride at 75 and 150 lb. per acre was applied in the presence and absence of potassium chloride.

This was superimposed on a test of the residual effect of dressings of nil, 3 tons and 6 tons of FYM in the previous season. As a further treatment gypsum was applied to a few half plots.

Flower counts were made and the seed cotton yields, ginning percentages, seed weights and lint lengths were studied. The residual effect of the FYM applications were very marked, the yields being: —

Nil FYM	578 lb. seed cotton per acre.
3 tons FYM	667 lb. seed cotton per acre.
6 tons FYM	726 lb. seed cotton per acre.

No good effects from sodium or potassium dressings were discernible. The yields for the plots which had not received any FYM in the previous season nor any gypsum this season, were: —

No sodium or potassium	657 lb. seed cotton per acre.
150 lb. sodium chloride	583 lb. seed cotton per acre.
200 lb. potassium chloride	618 lb. seed cotton per acre.
150 lb. sod. plus 200 lb. pot.	565 lb. seed cotton per acre.

No effects could be traced in the flower count figures, ginning percentages or other data. Gypsum also had no apparent effect.

Increased yield following application of farmyard manure in the previous season is usual. It can be explained entirely in terms of the phosphate content of the manure. Its effect is to increase the size of the plants and hence the number of fruiting points rather than to reduce the percentage of boll shedding. In this experiment the increased yield of the FYM treatments was more than accounted for by the extra flowers produced, viz., 6 tons FYM gave a 26% increase in yield but a 36% increase in flowering (judged on intermittent sample counts).

*D. P. Hopkins, World Crops, Vol. 2, No. 3, Aug. 1950, "Sodium as a Plant Nutrient".

Appendix.

Key to Strains Mentioned in the Report.

G. hirsutum.

Allen (Nigerian Allen)	The result of introducing from East Africa in 1912 seed of "Allen Long Staple" and growing the produce in Nigeria for 40 seasons.
26C (Samaru 26C)	A strain produced from Allen by repeated reselection by Botanists of the Department of Agriculture. Under trial since 1939 and now being issued for commercial growth in replacement of Allen.
New Nucleus Stock of 26C	The result of bulking the seed of 66 progenies chosen in the 1950-51 season as good typical specimens of true 26C.
BAR 17/1	A blackarm resistant strain selected in the Sudan from Nigerian Allen. Later renamed Albar 49.
BAR D28	A blackarm resistant selection made in the Sudan from the West African strain D28.
MU 8A	A hairy Malwa Upland strain selected in India by Dr. J. B. Hutchinson.

G. barbadense.

Sakel	The Sudan strain of the Egyptian Sakellaridis cotton.
X1730A	A strain derived from Sakel in the Sudan.
BAR 4/16	Blackarm resistant strain of X1730A bred in the Sudan.

Received November 1952.

ENTOMOLOGY

BY

A. F. H. BAILLIE.

Introduction.

Routine records on the incidence of pests and causes of crop loss have been continued from standard observation plots at Samaru, Daudawa, Gusau and Kontagora, and have been commenced in Adamawa Province centred at Yola. Records were also obtained from Mokwa in Niger Province. Ripe crop samples were received from the Agricultural Department at Gombe, in Bauchi Province. A stainer host preference trial was held at Samaru and observations on stainers on their wild hosts were made at all stations. The fate of tagged flowers was followed on the cotton plots of the stainer host trial. Further insecticide trials were held at Daudawa and at Samaru. Studies on the pupal periods of *Diparopsis* were recommenced; the results of these and of work on the emergence and diapause of *Platyedra* are not yet available.

Insect Pests.

Red Bollworm, Diparopsis perditor Clements.

Table 1 gives the figures for the last 3 years of the main peaks of egg laying per acre per week and larval populations (all stages) per acre and of total eggs laid per plant during the season.

Table 1.

Red bollworm, populations over three years.

	Eggs per plant			*Egg laying peaks*			*Larval peaks*		
	1949	1950	1951	1949	1950	1951	1949	1950	1951
Samaru Std.	2·5	1·2	5·0	9,420	3,790	11,670	3,130	4,110	2,910
Samaru Botanist	2·8	3·1	13·9	8,300	12,680	34,920	3,200	2,350	2,290
Daudawa	1·6	12·9	9·3	8,020	20,010	20,760	1,020	2,163	3,360
Gusau	2·5	3·4	4·6	4,180	9,020	9,190	1,810	7,240	6,600
Kontagora	5·1	15·1	10·7	14,400	27,770	18,350	3,630	5,850	2,680
Adamawa—									
Std. plot Yola			0·88			6,400			2,720
Peasants Yola									1,460
Peasants Jada									680
Peasants M. Belwa									3,170
Mokwa—									
Farm									3,430
Settlers									1,510

There was a remarkable increase in the severity of attack at Samaru. On the Botanist's rotation plots, egg laying was the highest yet recorded, reaching a peak of 35,000 per acre per week (see table 1). The attack developed earlier than last year, and even earlier at Daudawa, reaching 3,800 eggs per acre per week by the end of August. Elsewhere, except at Kontagora, the attack came early in September.

The attack was generally prolonged. A high level was maintained at Daudawa until well into December, 20,700 eggs per acre being recorded on the standard plot in the week ending 7th December 1951. The same was true at Samaru where there were 12,400 eggs per acre on the rotation plots in the week ending 28th December: at Kontagora, where there is a general tendency to lateness, the attack was maintained until mid-February when eggs numbered 2,300 per acre. In both 1950 and 1949 eggs were counted later here than at other stations. No egg counts were made at Mokwa but the numbers of larvae in samples in January indicated a similarity to Kontagora.

At all other stations (except Yola) there were numbers of 2,000 to 5,000 eggs per acre up to the end of January 1952, which is later than in previous seasons. The prolonged 1951 rainfall may be concerned. The pupal studies started in 1951 do not reflect this lateness, normal short term emergence not continuing long enough to account for this very late egg laying.

One would have expected larvae to have been plentiful in the crop throughout January, but this was not so. In fact, after December larvae

could be found only in small numbers at Kontagora, at Mokwa, and on the insecticides trial at Samaru. Presumably, conditions by this time are so dry as to prevent the development of eggs and very young larvae.

Pink Bollworm, Platyedra gossypiella.

Peak populations per acre from green boll samples of the crop were as follows:—Samaru rotation plots, 6,060; Daudawa nil (but records ceased early); Kontagora 890; Gusau 25,130; Mokwa 1,450. None was recorded from the standard plot at Yola but the peak per acre on Yola peasants was 570; on Jada peasants 1,890; and on Mayo Belwa peasants 2,380.

There was a very heavy increase in the incidence of this pest at Gusau and to a smaller extent at Samaru, the peak populations last year having been 1,000 and 1,400 respectively. At these two stations considerable numbers were also found in the ripe boll samples, reaching peaks of over 4,000 per acre in mid January 1952 at Gusau, over 1,000 per acre in early January at Samaru on the rotation plots, and over 5,000 per acre in mid January on the neighbouring stainer host preference trial. The *Hibiscus esculentus* plots were probably responsible for the build-up; 800 larvae per acre were found on these in August 1951. At no other station were appreciable numbers found in the ripe boll samples. The reason for the extraordinary and very local increase at Gusau is not clear. When the samples from the different ginneries have all been examined more light may be shed on this. A survey at Gusau ginnery in March revealed "large numbers" in the rubbish heap.

The emergence and diapause of pink bollworm are again being studied. 387 larvae and pupae have been set from collections taken at end of the 1951-52 crop, and from these 98 emergences from short term larvae have been recorded—mostly in December (43) and January (23). An emergence table will be prepared later.

Other Bollworms.

Earias spp. were commonest at Kontagora, Mokwa, and Samaru (rotation plots). At the last place the peak recorded was low, but the infestation was continuous from mid October to mid February. Populations per acre reached 2,680 at Kontagora in February, and 4,900 at Mokwa at the end of November. In Adamawa they were scarce except at the season's end. *Argyroploce* was scarce everywhere except in Adamawa, where populations generally exceeded 3,000 per acre in late November-early December. *Heliothis* was commoner this year, ranging between 500 and 1,000 per acre at Daudawa, Samaru, and Adamawa.

Stainer, Dysdercus superstitiosus.

Stainer populations at Samaru were much higher than in the previous year. On the standard plot there was a peak population of adults per acre of 3,700 (30th November 1951) and on the rotation plots 6,270 per acre (23rd

November 1951). Populations were low elsewhere except Mokwa (4,360), Kontagora (1,150) and Adamawa peasants (2,900, 3,870 and 2,300). They first appeared in early September in cotton, where they bred, finally leaving at the end of February.

Observations on alternative hosts were commenced in March 1951 and are summarized in Table 2. *Adansonia digitata* is considered the most important in that it can support a population over a long period and is the most widely distributed host tree.

TABLE 2.

THE HOSTS OF *Dysdercus superstitiosus*.

	Adansonia digitata	*Bombax buonopozense*	*Ceiba pentandra*	*Sterculia setigera*
Occurrence	Widespread and frequent	Widespread and fairly frequent	Widespread but not frequent except near villages	Uncommon in most parts
Period of flowering	May-June	Nov.-Feb.	Dec.-Jan.	Not recorded
Ripening of fruits	Oct.-Nov.	Feb.-June	March	Dec.-Jan.
Stainers present	Nov.-Aug.	March-May	March-May	Jan.-Mar.
Numbers { nymphs	(a)	60 (b)	100 (c)	Few
recorded { adults	(a)	15 (b)	50 (c)	Few
Apparent importance as a host	Most important	Important	Less important, being infrequent	Unimportant

(a) Varying numbers from November to August, but never so frequent as on *Bombax* or *Ceiba*. Associated with fallen fruits which persist for most of the year.

(b) Per 10 sq. yards of ground on shady side of tree in second half of April.

(c) As for (b) with large numbers on the trunk itself also.

Other hosts on which all stages of *D. superstitiosus* have been seen are *Zizyphus spina-Christi* (Rhamnaceae) and *Waltheria americana* (Sterculiaceae), both mentioned in the previous report. All stages were seen on *Zizyphus* in April and May 1951, and in 1952 adults were first seen on 17th March and nymphs on 25th March. On *Waltheria* all stages were seen in the early rains in Adamawa Province in 1951. The possibility that these might have dispersed from the other hosts has been borne in mind, but the evidence so far suggests that this is unlikely. All stages have also been seen on *Hibiscus* near *asper* and other, undetermined, members of this genus. Stainers were seen breeding on *asper* in October only, but it is expected that the cycle is much the same as on *Hibiscus cannabinus*.

At Mokwa total counts were made on *H. cannabinus*. 31,000 per acre were recorded on 7th December 1951. On sunflower, the numbers were again very low. Counts were also made on 86 different sorghum varieties, which

taken as a whole reached a peak on 19th October 1951 (328 per acre). On all except two varieties numbers were small. These were Kullum Ahmer from the Sudan (7,800 per acre on 18th October) and U.S. 12, a Uganda variety from Nyasaland (6,100 per acre on 27th September).

During 1951 a trial was held at Samaru to study the cycle of breeding and feeding upon a variety of cultivated and semi-wild host plants. The 9 hosts used are listed in Table 3. Planting was carried out at the normal date, or at the time of natural regeneration. Plots of approximately 1/32 acre were used, there being 4 replications in randomized blocks.

TABLE 3.

STAINER HOST PREFERENCE TRIAL, SAMARU 1951-52.
HOSTS, DATES OF SOWING AND HARVESTING.

Description of Host	*Date of Sowing*	*Harvesting etc.*
Hibiscus esculentus (Okra) A common cultivated vegetable	26th May	Left standing until following March
H. cannabinus (Rama) A common cultivated fibre crop	8th June	Left standing until following March
H. sabdariffa (Roselle) One of several *Hibiscus spp.* common on uncultivated land	11th June	Left standing until following March
Sorghum sp. (Guinea corn variety Kaura) A common grain crop. Dwarf, compact-headed; sometimes attacked by stainers	26th May	Harvested 2nd Dec.
Gossypium hirsutum [American (Allen) cotton]	5th July	Harvested 9th Nov.-15th Feb.
Urena lobata Wild, sometimes cultivated, fibre plant	8th June	Left standing until following March
Helianthus annuus (Sunflower) Cultivated crop	9th June	Harvested 5th Nov.
Pennisetum typhoideum (Bulrush millet) Cultivated crop, normally planted and harvested earlier than sorghum	26th May	Harvested 1st Sept.
Sorghum sp. (Guinea corn var. *Farafara*) A grain crop. Tall, lax-headed; rarely attacked by stainers	26th May	Harvested 18th Dec.

Adults were first recorded on 26th July on millet, *H. cannabinus* and *H. esculentus*. There was no breeding on millet, and adults had reached a peak of only 350 per acre at harvesting on 1st September. No breeding was seen elsewhere on millet in 1951, though nymphs have been seen on the crop in previous years. The importance of this crop is obscure and requires further study.

TABLE 4.

STAINER HOST PREFERENCE TRIAL, SAMARU 1951-52.

FRUITING BEHAVIOUR OF HOST PLANTS AND POPULATION OF *D. superstitiosus*.

Host	*First flower*	*Peak of fruiting*	*First record*		*Max. immigration*	*Total pop.* per 10 plants*		*Peak pop. per acre*		
			Adults	*Nymphs*		*Adults*	*Nymphs*	*Adults*	*Nymphs*	†*Date*
H. esculentus	26th July	12th Oct.	26th July	10th Aug.	31st Aug.	150	357	9,000	41,000	9th Nov.
H. cannabinus	24th Aug.	12th Oct.	26th July	21st Sept.	14th Sept.	83	226	16,000	79,000	2nd Nov.
H. sabdariffa	5th Oct.	21st Dec.	31st Aug.	12th Oct.	19th Oct.	42	142	3,100	30,300	14th Dec.
Kaura	5th Oct.	16th Nov.	24th Aug.	19th Oct.	12th Oct.	19	55	1,500	9,800	16th Nov.
Cotton	7th Sept.	2nd Nov.	31st Aug.	19th Oct.	gradual	19	35	1,600	4,500	2nd Nov.
U. lobata	14th Sept.	11th Jan.	10th Aug.	19th Oct.	21st Sept.	19	17	1,400	4,400	9th Nov.
Sunflower	17th Aug.	12th Oct.	10th Aug.	21st Sept.	7th Sept.	20	4	2,500	670	28th Sept.
Millet	26th July	31st Aug.	26th July	—	24th Aug.	14	0	450	0	31st Aug.
Farafara	28th Sept.	16th Nov.	31st Aug.	19th Oct.	indefinite	4	2	750	35	9th Nov.

*Total numbers counted over the whole season on 10 plants. As different hosts have different lengths of fruiting these figures integrate intensity and length of infestation.

†The date of the peak population was the same for both adults and nymphs, except in the case of sunflower.

Breeding commenced on *H. esculentus* very early (28th September 1951) and by 9th November a population of 9,000 adults and 41,000 nymphs per acre was reached. Breeding on *H. cannabinus* commenced two weeks later (12th October) and by 2nd November a population of 16,000 adults and 79,000 nymphs per acre was present. These then spread on to cotton and Kaura sorghum in which breeding started on 19th October and 2nd November respectively. By 2nd November there was a total of 1,600 adults and 4,500 nymphs per acre on cotton and by 16th November a population of 1,500 adults and 9,800 nymphs on Kaura. At about the same time (12th October) breeding started on *H. sabdariffa*, the peak population being reached later—14th December—a total of 33,400 per acre of which 3,100 were adults.

It is notable that even with these vast numbers as a source of infestation only comparatively few were recorded on the other hosts. Even on cotton the peak of 1,600 per acre was not abnormal for 1951. Kaura sorghum was the only non-malvaceous host on which any degree of breeding took place.

A few stainers were still to be found on *H. sabdariffa, H. esculentus* and cotton up to the end of February and on *H. cannabinus* in late January. Stainers left other hosts early, millet and sunflower because of harvesting.

No clear-cut cycle of infestation was shown by this trial, probably due in part to plot interaction. A very definite preference for the *Hibiscus* hosts was shown.

Table 4 gives details of fruiting and stainer populations, the latter in order of preference.

On the basis of the stainer host trial and one year's observations on wild hosts, the yearly cycle has been compiled and is summarized in the following table. The numbers in the columns are arbitrary and give only an approximate indication of numbers seen in that particular month. Thus 0 is nil, 1 is rare, 2 is occasional, 3 is frequent, and 4 is abundant.

In interpreting this table, the great differences in densities of the different hosts must be remembered. *H. sabdariffa,* for instance, occurs only as scattered plants.

One of the critical periods in the cycle appears to be from May to July. In the absence of *Waltheria* and ratoon cotton, stainers are reduced to the very few found on *Ceiba, Bombax* and *Adansonia.* The last has nearly always shed its fruits by this time and they have dried up or been removed by the villagers. It seems that during this period stainers lead a rather precarious existence in the bush when all stages, particularly later ones, may be found far from known host plants. The other critical period is February, when continuation of the cycle depends on *Sterculia,* which is scarce, late planted cotton, *Adansonia* and *Hibiscus sabdariffa.*

It is impracticable to do any large scale control on the lines practised in Kordofan, Sudan, since hosts are so various and widespread. To reduce stainers in a particular vicinity, it might be effective to spray the hosts listed under February and March in Table 5, particularly *Ceiba* and *Bombax*. During June stainers are too scattered throughout the bush and plenty of moisture is available then.

TABLE 5.

ANNUAL CYCLE OF COTTON STAINERS.

	Jan.	*Feb.*	*March.*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Ceiba pentandra	0	0	2	4	2	1	1	0	0	0	0	0
Adansonia digitata	2	2	2	2	2	2	2	0	0	0	2	2
Bombax buonopozense	0	0	2(a)	3	2	1	1	0	0	0	0	0
Sterculia setigera	1	1	1	0	0	0	0	0	0	0	0	0
Zizyphus spina-Christi	0	0	1	2	1	0	0	0	0	0	0	0
Waltheria americana	0	0	?(b)	?	3	3	2	0	0	0	0	0
Cotton	1	1	0	0	1*	1*	1*	1*	2	3	3	2
Sunflower	0	0	0	0	0	0	0	1	1	1	1	1
Sorghum vulgare	0	0	0	0	0	0	0	1	1	2	2	1
Bulrush millet	0	0	0	0	0	0	0	1	?(c)	0	0	0
Urena lobata (d)	0	0	0	0	0	0	0	1	1	1	1	0
Hibiscus cannabinus	1	0	0	0	0	0	0	1	2	3	4	2
H. esculentus	?	1	0	0	0	0	0	1	2	3	4	2
H. asper	?	0	0	0	0	0	0	?	?	2	?	?
H. sabdariffa	1	1	0	0	0	0	0	0	1	2	3	4

*Ratoon.

Notes: (a) First seen in February in Niger Province.
(b) It is not yet known when stainers first attack *Waltheria*.
(c) Position in September uncertain.
(d) Quite common in the bush but stainers only seen on it in the host preference trial.

Campylomma sp.

The 1951 season was marked by a very substantial extension of the incidence of *Campylomma*. Large populations were seen at Daudawa, Kontagora, Mokwa, Samaru and some peasant plots in Zaria and Katsina Provinces. It was scarce at Gusau, and has also been recorded at Yola. At Samaru adults were first recorded on 16th July on standover cotton Routine sweeps on the cotton plots of the stainer host preference trial began on 20th August, when 200 per acre were collected. Thereafter the population increased to a peak of 7,580 swept per acre on 8th October (cf. 17,300 on 7th November 1950), and then diminished, disappearing by the New Year. Judging from the numbers seen in Niger Province in mid December, the peak was much later there. Despite the impression that numbers were less at Samaru in 1950, tattering was certainly in excess of 1950.

At Daudawa, in particular, leaf tattering was generally serious and in parts severe. On the tractor unit farm this was associated with the shedding of formed buds, resulting in a late and poor crop carried mainly on the upper nodes.

To test whether *Campylomma* is capable of causing this type of damage, muslin cages were constructed 4 feet high by 1-1½ feet in diameter, covering cotton plants sown in tins in the insectary. These plants were infected with both adults and nymphs just before buds formed. A few adults and nymphs (final instar) were put at intervals into three of these cages. None survived for long, and in these cages no symptoms occurred. In the fourth cage, about 20 adults were added every 5-6 days, in all 190 over a period of 7 weeks. As a result all the symptoms of severe tattering were induced, but only by using populations greatly in excess of those found under natural conditions. Breeding occurred on a very small scale, but it is doubtful whether the population would have survived without regular reinforcement.

Young stages of *Campylomma* have been recorded on the following host plants: *Urena lobata, Hibiscus sabdariffa, H. cannabinus,* Cowpea (*Vigna*), *Phaseolus aureus* and *Sorghum caudatum*. The most favoured were cowpea and *S. caudatum,* and the former exhibited a type of damage very similar to leaf tattering in cotton.

Campylomma adults have also been recorded on the food plants *Sesamum indicum* (benniseed), *Indigofera indica* and *Sorghum guineense*.

The factors affecting the spread and increase of *Campylomma* are unknown. Extensive areas of cotton apparently favour large populations. Small areas of cotton interspersed with more favoured host plants may be lightly attacked. Succulence may increase susceptibility to leaf tattering, it being noticeable that native cotton grown near streams and on damp soil suffered severely.

It is probable that *Campylomma* caused a marked depression in yields in 1951, on Government farms and on early planted peasants' cotton. The fact that most peasants plant late, and that less tattering is seen on late,

poorer grown crops, makes it doubtful whether *Campylomma* had a noticeable effect on the bulk of the commercial crop.

Miscellaneous Pests.

Other insects noted, but not considered important, were: *Lygus,* which was common on *Phaseolus aureus* and occurred on cowpea, but was rare on cotton; *Sylepta derogata*; *Oxycarenus sp.*; *Agnoscelis versicolor* and *Calidea sp.* *Heliopeltis* was not seen at any station this year.

Crop Loss.

Shedding.

In 1951 the general level of both bud and boll shedding was less than in 1950, except at Gusau. As in previous years the records suggest that many more bolls than buds were shed, but this may be due to failure to recover all the shed buds in the twice-weekly collections. On the flower-tagging experiment, where daily collections were made with particular care, shed buds amounted to almost two-thirds of shed bolls.

The heaviest boll shedding was again at Samura; on the rotation plots the peak figure was 14,400 per acre per week in November, and on the flower tagging experiment 21,000 per acre per week in October. Bud shedding on the latter experiment reached a peak of 12,000 per acre per week, whilst on the standard plots it never exceeded 5,000 and the general level was of the order of 2,000 per acre per week.

The results from all areas are shown in Table 6. At Daudawa shedding records were discontinued on 7th November, owing to pressure of work on the insecticide trials.

Table 6.

Percentage damage by bollworms amongst shed buds, shed and aborted bolls and ripe bolls.

Station	*Shed Buds*	*Shed and Aborted bolls*	*Ripe Bolls*
Daudawa std.*	47·0	29·7	26·6
Samaru std.	52·3	30·7	24·7
Samaru rot.	62·7	36·7	44·3
Kontagora std.	63·3	59·9	75·2
Gusau std.	42·2	41·4	65·5
Yola std. (*punctatum*)	42·0	18·1	42·8
(Allen)	26·8	24·7	32·9
Yola peasant	—	—	29·7
Jada and Mayo Belwa peasants	—	—	34·9
Mokwa C.D.C. farm	49·5	27·9	46·2
Mokwa settler	61·1	38·8	33·2

*Discontinued 7th November.

Shedding due to bollworm at Samaru was much greater than last year. The records from Yola, in contrast to those of 1951, suggest that non-bollworm damage is greater than that due to bollworm.

The humidity drop came a fortnight later this year and appears to have a flattening effect on the shedding curve. The high shedding peaks in 1950 are associated with the sudden drop in humidity. In 1951 much of the crop had flowered and set bolls before dry conditions prevailed. Table 8 shows that (a) more bolls were formed per plant and (b) the non-bollworm sheds were less than last year (cf. 1950-51 report, Table 11, Sowing B). The total number of bolls matured, however, is not greater, because there was a greater loss due to bollworm in both shed and non-shed bolls. The late rains evidently enabled much of the crop to set its fruit before the onset of dry conditions. This has resulted in a greater crop production, coincident with an increase in bollworm damage, an effect which is found in the early sowings in normal years.

TABLE 7.

FLOWER TAGGING EXPERIMENT, SAMARU 1951. NUMBERS AND FATE OF BOLLS FORMED PER PLANT.

Bolls formed per plant	*Bolls shed and aborted*		*Bolls matured*		*Other losses (Mammals)*
	BW	*NBW*	*BW*	*NBW*	
15·26	3·86	5·54	3·40	2·33	0·13

Damage to Mature Bolls.

Figures were obtained by grading ripe bolls lock by lock (Table 8). Bollworm partial loss locks are those in which there is some bollworm damage, but not enough to destroy the entire lock; bollworm complete loss locks are those completely destroyed by bollworm. Locks graded as non-bollworm partial loss are those in which the lint is fully formed but has suffered some discoloration. Locks graded as non-bollworm complete loss are those in which the lint has not matured properly and is brown or black and matted together. The figures in the non-bollworm partial loss column are surprisingly high and stainers cannot be entirely concerned; bacterial boll disease probably plays a considerable part, but it is possible that *Argyroploce* can also be incriminated, especially as the highest figures were at Yola, where this pest is far more prevalent than at any other station.

The most striking features are the very low proportion of clean locks, except at Gusau (peasants) and Samaru (standard), and the marked differences between stations.

TABLE 8.

PERCENTAGE LOCK DAMAGE IN NON-SHEDDING BOLLS.

Station	*Clean*	*BW partial loss*	*BW complete loss*	*Non BW partial loss*	*Non BW complete loss*
Daudawa std.	58·7	4·9	7·6	24·0	4·9
Samaru std.	70·5	3·2	6·9	14·4	5·0
Samaru rot.	54·6	7·2	11·2	20·0	7·0
Kontagora std.	25·9	13·6	20·8	26·2	13·6
Gusau std.	47·3	21·6	7·8	15·3	8·0
Yola std.—					
punctatum	31·9	6·1	4·5	39·4	18·8
Allen	31·9	4·2	4·4	40·1	19·2
Yola peasant	38·2	1·4	2·3	49·0	9·1
Jada and Mayo					
Belwa peasants	37·7	2·5	3·4	35·2	20·5
Mokwa: C.D.C. farm	31·8	13·1	12·5	27·9	14·6
Mokwa: settler	51·2	8·6	7·8	25·6	6·9
Samaru stainer trial	34·8	18·9	19·0	17·9	9·5
Gusau peasants	70·3	7·9	5·4	11·3	5·0

Note: Daudawa std. was in the experimental area.

INSECTICIDE TRIALS.

Three insecticide trials were held in 1951, two at Daudawa and one at Samaru. The first was in the experimental area adjacent to the standard plot; the second was in Stage 1 main farm. The third was at Samaru on some freshly cleared land near the Botanist's farm.

Insecticide Trial No. 1.

This was laid out on 6 randomized blocks of 5 plots each of approximately 1/58 acre. A proprietary dust was used in all treatments, containing 5% DDT, 3% gamma BHC and 40% sulphur. The planting date was 9th July and pickings started at the end of November and continued until early March.

TABLE 9.

INSECTICIDES TRIAL NO. 1—DAUDAWA.

TREATMENTS AND YIELDS IN LB. SEED COTTON PER ACRE.

Treatment	*Number of applications*	*Dates*	*Rate lb. dust per acre*	*Dosage of DDT lb. per acre*	*Yield*
1	2	24/10, 15/11	24·0	1·2	484
2	3	24/10, 15/11 5/12	17·8	0·9	469
3	2	24/10, 15/11	33·5	1·8	516
4	1	24/10	57·6	2·9	462
5	nil				506

Treatment differences were not significant.

The applications were made during the period of maximum red bollworm activity. Just after the first application, on 24th October, one inch of rain fell, which may have had an adverse effect on the results.

In this, as in the other two insecticide trials, a figure for bollworm attack on each treatment over the whole season was obtained by calculating, for every plot separately, the total number of larvae of the different bollworms collected, at weekly intervals, on a fixed number of plants corrected by the total number of bolls on these plants. This figure is taken as a bollworm index for the treatment, and was analysed by a square root transformation of the individual plot figures. In this trial, treatment 4 gave a bollworm index significantly lower by about 75% than that for treatments 1 and 5.

Analyses of clean and bollworm locks showed no significant differences between treatments.

Although the bollworm index in treatment 4 was significantly lower than in treatments 1 and 5, it was not followed by an increase in yield.

Insecticide Trial No. 2.

The layout was in 6 randomized blocks of 5 plots, each of approximately 1/45 acre. Approximately 45 gallons of a 1·5% DDT emulsion was used in all treatments. On 5th December 36 gallons of a 0·1% gamma BHC emulsion was applied to all treatments as a protection against a developing aphis attack. The planting date was 9th July and pickings continued from the end of November until early March. The object was to test different numbers and times of applications, and the details and yields are given in Table 10.

TABLE 10.

INSECTICIDES TRIAL NO. 2—DAUDAWA.

TREATMENTS AND YIELDS IN LB. SEED COTTON PER ACRE.

Treatment	*Number of applications*	*Dates*	*Rate lb. DDT per acre*	*Yields*
1	1	25/10	6·6	485
2	1	16/11	6·4	486
3	2	25/10, 16/11	7·0	588
4	3	25/10, 16/11, 5/12	6·5	593
5	nil			385
S.E.				± 27

Treatments 1 and 2 gave significantly better yields than control at P = 5% and treatments 3 and 4 at P = 1%.

The bollworm index showed no significant differences in *Earias,* but all treatments except the first produced a significant diminution of the *Diparopsis* index, treatment 4 giving an 80% reduction. The figures for percentage of locks showing bollworm damage followed the same trend very closely. Again, the very large reduction in the bollworm index of treatment 4 was not accompanied by a proportionate increase in yield.

Conclusion: a single application is equally effective in October or November, and the two together give twice the increase of either singly, but later applications have no effect.

Insecticide Trial No. 3.

This was laid out in 7 randomized blocks of 6 plots, each of approximately 1/40 acre. The object of this trial was to see whether large and uneconomic quantities of DDT would cause spectacular increases in yields. There were two applications in which approximately 45 gallons of DDT emulsion per acre were applied at the strengths shown in the table. On 3rd December a third application was made, consisting of 30 gallons per acre of 0·5% gamma BHC only. The planting date was 9th July and harvesting continued from the end of November till late February.

TABLE 11.

INSECTICIDES TRIAL NO. 3—SAMARU.
TREATMENTS AND YIELDS IN LB. SEED COTTON PER ACRE.

Treatment	*Number of applications*	*Dates*	*Strength DDT*	*Rate lb. DDT per acre*	*Yields*
1	2	22/10, 12/11	0·5%	2·2	549
2	2	22/10, 12/11	1·5%	6·0	663
3	2	22/10, 12/11	2·5%	10·3	610
4	2	22/10, 12/11	3·5%	16·4	697
5	2	22/10, 12/11	5·0%	20·5	623
6	nil				482
S.E.					± 37

Significant differences in yields were at P = 5%.

All treatments except the first significantly outyielded the control, but although treatments 2 and 4 significantly exceeded treatment 1, they did not differ significantly from 3 and 5.

There was a bigger infestation of all species of bollworm, including pink bollworm, on this experiment than on the other two. There were significant reductions in both the bollworm index and the percentage locks showing bollworm damage; treatment 2 showing a 65% reduction on *Diparopsis* index, treatments 3 and 4 an 82% reduction and treatment 5 a 93% reduction. The reductions in lock damage followed the same trend, although they were not so great.

Treatments 4 and 5 might have given yet higher yields if it had not been for a severe scorching effect which appeared shortly after each application on these treatments. A figure for boll shedding was obtained in the same way as for bollworm attack, and the following table gives a boll shedding index for each treatment corrected by the number of plants used in counting these sheds.

TABLE 12.

INSECTICIDE TRIAL NO. 3, SAMARU. INDEX OF BOLE SHEDDING.

Treatment	1	2	3	4	5	6
Boll shedding index	475	477	466	490	510	470

There was no significance because of a rather high coefficient of variation (10·8%), but there is a general trend towards heavier shedding in the stronger treatments. This is evidently one symptom of this scorching, which was presumably caused by the solvent.

General Discussion on the Insecticides Trials.

All experiments show large reductions in bollworm indexes, but these differences exceed the differences in yields, and in trial 1 large reductions in bollworm are not followed by any increase in yields. Lock analyses follow the same trend as yields within each experiment, but the three experiments are not consistent between themselves, experiment 3 having much larger bollworm figures than experiment 2, but showing very much less bollworm damage. There is thus some suggestion that the increased yields which can be obtained from using insecticides are not entirely due to the control of bollworm which they exercise, but are due to the control of some other pest, e.g. stainers or Mirids. Figures for non-bollworm damage and stainer counts in the insecticide trials over the past three seasons tend to rule out the likelihood of increased yields being due to the control of stainers.

In the 1951-52 season Mirid damage was low in trial 1, where there was no effect of insecticides on yield, but a marked effect on bollworm populations. It was severe in trials 2 and 3, where there were marked effects of insecticides on yield, but the largest increases were on trial 2, which had least bollworm. This supports the possibility that part of the effect of insecticides is due to the control of Mirids. It is hoped to settle the question in the near future by comparing early and late applications of insecticides. Early applications would be primarily effective against Mirids and late against bollworm.

Received July 1952.